

REMARKS/ARGUMENTS

This is in full and timely response to the Office Action mailed November 29, 2002, submitted concurrently with a Petition for an Extension of Time to within the first extended month. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

By the foregoing amendment, claims 1, 9-12, 14 and 16 were amended. Claim 1 was amended to recite that the second step having the step of developing the substrate in the stationary condition while stopping the substrate for a second predetermined period of time after completing the first step, the step of making a concentration of the developing solution on the substrate uniform by stirring....the step thereafter further developing the substrate in a stationary condition while stopping the substrate for a third predetermined period of time, and the step of washing the substrate while rotating the substrate after the third predetermined period of time. Support for this amendment to claim 1 can be found variously throughout the specification, for example, at page 16, lines 6-10 and at page 16, line 25 to page 17, line 14. Claims 9-12 were amended to more clearly recite a first end and a second end, and were not made to overcome any applied or cited art. Claims 14 and 16 were amended to recite that the above rotation direction is the above rotation direction in which the substrate is rotated. No prohibited new matter was added. Claims 1-19 are currently pending, with claims 1-16 pending for the Examiner's reconsideration, with claims 1 and 17 being independent.

Rejections under 35 U.S.C. §112

Claims 11, 12, 14 and 16 are rejected under 35 U.S.C. §112, second paragraph.

By this Amendment, the "one end to another end" of claims 9 and 10 were amended to recite a first end and a second end for clarity. Accordingly, claims 11 and 12 were amended to refer to the first end and the second end. Withdrawal of this rejection is respectfully requested.

By this Amendment, claims 14 and 16 were amended to recite that the above rotation direction is the above rotation direction in which the substrate is rotated. Withdrawal of this rejection is respectfully requested.

Rejections under 35 U.S.C. §102

Claims 1, 2, 5, 9 and 10 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,984,540 to Mimasaka et al. or U.S. Patent No. 5,821,035 to Hirano et al. Applicants respectfully traverse this rejection.

Claim 1 recites a method of supplying a developing solution to a surface of a substrate to perform developing treatment for the substrate, comprising: a first step of supplying the developing solution to the surface of the substrate while a developing solution supply nozzle is moving relative to the substrate; and a second step of developing the substrate for a first predetermined period of time, said second step having the step of developing the substrate in stationary condition while stopping the substrate for a second predetermined period of time after the completion of said first step, the step of making a concentration of the developing solution on the substrate uniform by stirring the developing solution on the surface of the substrate after the second predetermined period of time, the step of thereafter further developing the substrate in stationary condition while stopping the substrate for a third predetermined period of time, and the step of washing the substrate while rotating the substrate after the third predetermined period of time.

As described in the specification, after a developing solution is supplied to the entire surface of the substrate and a developing solution film is formed, the substrate is subjected to developing treatment while remaining stationary for a predetermined period of time. The resist film and the developing solution at an exposed portion, which becomes soluble in the developing solution by exposure, chemically react with each other to dissolve the exposed portion, whereby developing progresses.

In this case, it was found by experiment by the inventors that when a developing solution supply nozzle supplies the developing solution while moving in a predetermined direction, there occurs a so-called flow phenomenon of the developing solution, in which the supplied developing solution flows in a direction opposite to a moving direction of the developing solution supply nozzle, that is, in a direction from a first end to a second end of the substrate.

When the developing solution with a high concentration which is at an unexposed portion and not yet used for a chemical reaction flows into an adjacent exposed portion under such a phenomenon, however, the chemical reaction speed at this exposed portion increases, and hence

the developing speed at this portion increases compared with other portions. As a result, a line width at this portion becomes narrower compared with those at other portions.

Meanwhile, when the developing solution with a low concentration which is at an exposed portion and used for a chemical reaction flows into an adjacent exposed portion, the reaction speed at this exposed portion decreases, and hence the developing speed at this portion decreases, whereby a line width at this portion becomes wider compared with those at other portions. Specifically, the developing speed within the surface of the substrate becomes non-uniform due to the aforementioned phenomenon.

The present invention solves the aforementioned problems, and “the step of developing a substrate in stationary condition while stopping the substrate for a second predetermined period of time after supplying a developing solution to the substrate”, thereafter “the step of making a concentration of the developing solution on the substrate uniform by stirring the developing solution on the surface of the substrate”, “the step of thereafter further developing the substrate in stationary condition while stopping the substrate for a third predetermined period of time”, and “the step of washing the substrate while rotating the substrate after the third predetermined period of time” are provided.

When developing progresses to some extent in the first half of the second step in which the substrate is developed for the second predetermined period of time, the concentration of the developing solution on the substrate becomes non-uniform for the previously mentioned reason. In the present invention, however, the concentration of the developing solution on the substrate is made uniform by stirring the developing solution on the surface of the substrate. Thereafter, the substrate is further developed in stationary condition while being stopped for the third predetermined period of time, whereby uniform developing treatment progresses for the entire substrate. Then, after the third predetermined period of time, the substrate is washed while being rotated.

The aforementioned background in which the present invention is made, problems, discovery of causes, and elements of the present invention to solve the problems are not disclosed, taught or suggested in the applied references.

In Mimasaka et al. '540 and Hirano et al. '035, a substrate is rotated after a predetermined period of time, but this is an operation for casting off a developing solution on the substrate from the substrate after developing is completed. This is also evident from a fact that

water is supplied immediately thereafter to wash the substrate. Namely, the step of developing the substrate in stationary condition again while stopping the substrate after stirring the developing solution on the substrate is not disclosed, taught or suggested in either Mimasaka et al. '540 and Hirano et al. '035.

A document can only anticipate a claim if the document discloses, explicitly or implicitly, each and every feature recited in the claim. Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Since Mimasaka et al. '540 and Hirano et al. '035 each fail to disclose, either explicitly or implicitly, at least the above-noted features recited in independent claim 1, Mimasaka et al. '540 and Hirano et al. '035 each cannot anticipate the claim. At least in view of the foregoing, claim 1 is allowable, and the rejection should be reconsidered and withdrawn.

Dependent claims 2, 5, 9 and 10 depending from claim 1 are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §102(b) rejection is therefore respectfully solicited.

Claims 1, 2, 5, 13 and 15 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,740,488 to Fujimoto. Applicants respectfully traverse this rejection.

In Fujimoto '488, it is disclosed that after a developing solution is supplied, the developing solution is applied uniformly by rotating a substrate and thereafter developing treatment is performed. However, it is not disclosed, taught or suggested that at some time in the middle of the developing treatment, the developing solution on the substrate is stirred by rotating the substrate again or the like so that the concentration of the developing solution is made uniform, and the substrate is developed again in stationary condition.

A document can only anticipate a claim if the document discloses, explicitly or implicitly, each and every feature recited in the claim. Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Since Fujimoto '488 fails to disclose, either explicitly or implicitly, at least the above-noted features recited in independent claim 1, Fujimoto '488 cannot anticipate the claim. At least in view of the foregoing, claim 1 is allowable, and the rejection should be reconsidered and withdrawn.

Dependent claims 2, 5, 13 and 15 depending from claim 1 are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §102(b) rejection is therefore respectfully solicited.

Claims 1-5 and 13-16 are rejected under 35 U.S.C. §102(b) as being anticipated by Japanese Patent No. 63-132429A. Applicants respectfully traverse this rejection.

In JP '429, it is disclosed that the substrate is rotated after being developed in stationary condition, however water is also supplied on this occasion. Accordingly, the rotation of the substrate in JP '429 is not an operation for "stirring" but rather is an operation for casting off the developing solution from the substrate after the completion of developing. JP '429 does not disclose, teach or suggest that after the substrate is rotated, the substrate is developed again in stationary condition.

A document can only anticipate a claim if the document discloses, explicitly or implicitly, each and every feature recited in the claim. Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Since JP '429 fails to disclose, either explicitly or implicitly, at least the above-noted features recited in independent claim 1, JP '429 cannot anticipate the claim. At least in view of the foregoing, claim 1 is allowable, and the rejection should be reconsidered and withdrawn.

Dependent claims 2-5 and 13-16 depending from claim 1 are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §102(b) rejection is therefore respectfully solicited.

Claims 1-5 and 13-16 are rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,248,175 to Subramanian et al. Applicants respectfully traverse this rejection.

In Subramanian et al. '175, it is not disclosed that after a developing solution is supplied to a substrate, the substrate is developed in stationary condition while being stopped, the

developing solution on the substrate is stirred after a predetermined period of time so that its concentration is made uniform, and thereafter the substrate is developed again in stationary condition. In Subramanian et al '175, after the substrate is developed in stationary condition, only the thickness of a developed resist film is measured.

As discussed above, a characteristic of the present invention that after the developing solution is supplied to the substrate, the substrate is developed in stationary condition while being stopped, the developing solution on the substrate is stirred after a predetermined period of time so that its concentration is made uniform, thereafter the substrate is developed again in stationary condition, and then the substrate is washed is not disclosed in the respective citations. Moreover, the respective citations show no evidence of consideration of non-uniform developing condition which occurs when the developing solution is supplied while the nozzle is moving, and thereafter developing treatment is performed by only developing in stationary condition, and its reasons and causes.

A document can only anticipate a claim if the document discloses, explicitly or implicitly, each and every feature recited in the claim. Verdegall Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Since Subramanian et al. '175 fail to disclose, either explicitly or implicitly, at least the above-noted features recited in independent claim 1, Subramanian et al. '175 cannot anticipate the claim. At least in view of the foregoing, claim 1 is allowable, and the rejection should be reconsidered and withdrawn.

Dependent claims 2-5 and 13-16 depending from claim 1 are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §102(e) rejection is therefore respectfully solicited.

Rejections under 35 U.S.C. §103

Claims 6-8 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,248,175 to Subramanian et al. Applicants respectfully traverse this rejection.

Claims 11-12 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,821,035 to Hirano et al. in view of Japanese Patent No. 63-132429A. Applicants respectfully traverse this rejection.

As mentioned previously, the characteristic of the present invention that after the developing solution is supplied to the substrate, the substrate is developed in stationary condition while being stopped, the developing solution on the substrate is stirred after a predetermined period of time so that its concentration is made uniform, thereafter the substrate is developed again in stationary condition, and then the substrate is washed is not disclosed in the respective citations. Moreover, the respective citations show no evidence of consideration of non-uniform developing condition which occurs when the developing solution is supplied while the nozzle is moving, and thereafter developing treatment is performed by only developing in stationary condition, and its reasons and causes.

Accordingly, the invention in claims 6 to 8 and 11 to 12 having the characteristic of claim 1 is not obvious to any person with an ordinary skill from Subramanian and Hirano.

At least in view of the foregoing, claims 6-8 and 11-12 are allowable, and the rejection should be reconsidered and withdrawn.

Moreover, dependent claims 6-8 and 11-12 depend from claim 1, and are also allowable for the reasons above. Moreover, these claims are further distinguished by the materials recited therein, particularly within the claimed combination. Withdrawal of the §103(a) rejections is therefore respectfully solicited.

Conclusion

For the foregoing reasons, claims 1-16 are in condition for allowance. Accordingly, favorable reexamination and reconsideration of the application in light of these amendments and remarks is courteously solicited. If the examiner has any comments or suggestions that would place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the number below.

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Respectfully submitted,

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